fresh-water streams and lakes for its period of growth but returns to the deep sea to spawn. CHARLES A. KOFOID.

The Valves in the Heart of Fishes.—The following note by Dr. H. D. Semor, of the College of Medicine in Syracuse University, New York, on the valves in the heart of fishes should be put on record.

It may be noted that in the so-called ganoid fishes there is more than one row of valves and from these ganoid fishes are derived the herring-like fishes. Some of these, as Dr. Senior has noted, have two rows of valves. Others have but a single one as in ordinary fishes.

"With regard to the question of teleosts having a conus arteriosus provided with more than one row of valves: In addition to Albula[1] which has long been known to have two rows, I have found a conus with two rows of valves (each row having two cusps) in *Tarpon atlanticus*,[2] *Megalops cyprinoides*,[3] and in *Pterothrissus gissu*.[4] I think this list will prove to be complete, as I have examined, with a negative result, Elops,[2] Chirocentrus,[5] Chanos,[3] Dorsosoma,[2] Notopterus,[2] Pomolobus,[5] Alosa,[5] Brevoortia,[5] and Boas has examined Osteoglossum.[6]

"A well-marked or vestigial conus arteriosus with *one* row of valves only, occurs in Elops,[4] Hyodon,[5] Chirocentrus,[5] Chanos,[3] Notopterus,[6] Osteoglossum[6] and Dorosoma.[2] That it also occurs in other allied genera, I have little doubt. When I collect enough specimens, I intend to describe and figure the conus (or vestige) in a sufficient number to indicate its mode of disappearance." DAVID S. JORDAN.

PARASITOLOGY

The Hereditary Transmission of Germ Diseases.—The earlier views which favored hereditary transmission of germ diseases have been subjected for nearly half a century to careful scrutiny at the hands of bacteriologists and are now generally rejected. Experimental evidence has been furnished from many quarters that the supposed cases are due to a contamination of the offspring during transit through the maternal passages at birth, or

[1] Stannius. Bemerkungen über das Verhaltniss der Ganoiden zu den Clupeiden, insbesondere zu Butirinus Rostock, 1846. Boaz. *Morph. Jahrb.*, Bd. 6, p. 527.

[2] Senior. *Biol. Bull.*, Vol. XII, p. 146.

[3] Senior. *Biol. Bull.*, Vol. XII, p. 378.

[4] Senior. *Anatomical Record*, Vol. 1, No. 4, p. 82. (*Am. J. of Anatomy*, Vol. VI, No. 4.)

[5] My own notes, unpublished.

[6] Boaz. *Morph. Jahrb.*, Bd. 6, p. 527.

occasionally to infection *in utero*, although in the majority of cases the cord and placenta form a barrier to the transmission of bacteria. Even when the bacteria gain entrance into the fetus there is no adaptation to the reproductive process.

Until very recently the part played by animal organisms in the transmission of diseases has been regarded as of very minor importance, and for the few known instances the same view rules with reference to conditions of transmission as already noted for bacteria. In the case of malaria, the oldest known protozoal disease, many experiments have been made to determine the occurrence of transmission *in utero*, from mother to offspring, and not only the general facts but also the details have been established.

A long series of able investigators, among them our own W. S. Thayer, have found that the malarial organisms present in the maternal blood do not occur in the blood of fetus and of the newborn. It has been generally agreed that these hæmatozoa can not traverse the placenta from the pregnant mother to the fetus. Moreover Bignami et Sereni demonstrated that the fetus lacks not only the parasites, but also the anemia which often characterizes the mother. The subject has been subjected to most careful reexamination at the hands of two Greek investigators.[1] In every case the maternal blood contained malarial parasites in greater or less abundance. In blood taken from the maternal face of the placenta, parasites were abundant, in that from the opposite or fetal face they were absent or very rare. In blood taken from the umbilical cord and from the liver, kidney and other organs at autopsies, not a single parasite was demonstrated. Thus they confirmed absolutely the view that these haematozoa do not traverse the placenta.

An interesting departure from these conditions is afforded by recent investigations on other disease-producing protozoa. The experiments are not extensive and in some cases contradictory. Thus Massaglia[2] infected pregnant guinea-pigs with trypanosomes. In one case at death the liquor amnii contained trypanosomes, in the other not; but in neither case could any parasites be found in the blood of the fetus. On the other hand, Pricolo[3] found in mice a trypanosome which was capable of traversing

[1] Pezopoulos et Cardamatis, *Centr. Bakt. und Par.*, Orig., 43, 181.

[2] *Gaz. Ospedali ed Clinichi*, 1906, 12.

[3] *Centr. Bakt. und Par.*, Orig., 43, 231.

the placenta and affecting the young *in utero*. It also appeared to multiply rapidly in the fetal circulation.

In cases of congenital syphilis, *Treponema pallidum* has been shown to be present in small numbers in the blood taken from placenta and cord and undoubtedly has the power to pass through the placental tissue from maternal to fetal circulation. While a final decision can not be reached at present, the weight of evidence favors the view that Treponema is an animal rather than a bacterium. In some closely related forms the conditions have been more definitely established. Thus in *Spirochaeta duttoni*, the cause of African relapsing fever, Breinl and Kinghorn,[4] in four rats and one guinea-pig, demonstrated the passage of the spirochete through the placenta into the fetus. The parasites were found in the placenta in approximately the same numbers as in the heart blood of the mother, yet in very meager numbers in fetal blood. There was no tendency to abort, yet a large percentage of young died shortly after birth. The spirochetes from fetal heart blood showed themselves virulent on inoculation.

These and similar cases among animal parasites are not surprising. They differ from the accidental contamination of the young at birth in the case of bacterial diseases only in that the infecting agent is capable of migration through solid tissue and thus passes barriers in the placenta which constitute obstacles to the passage not only of bacteria but also of some other animal organisms, like the plasmodium already noted, which do not penetrate tissues, but pass their entire existence in the blood stream. So far as known there is no adaptation of the parasite to special conditions and the infection of the new generation *in utero* does not differ biologically from the infection of a new organ as the parasites wander through the body of the host. The transmission of the disease to a second generation is a biological incident and bears no especial relation to the reproductive organs or function.

Certain cases are known, however, in which the conditions are radically different. One of the first of these was the demonstration by Koch[5] of the life history of *Babesia* (= *Piroplasma*) *bigeminum*. In this he was able to determine that one form in development was found in the eggs of the tick by which the organisms are transmitted. This stage appears to be the means by which the young larvæ of the second generation of ticks are

[4] Liverpool School Trop. Med., Mem. 21.

[5] *Zeit. f. Hyg.*, 54, 1.

infected. It has long been known that young produced by infected ticks will transmit certain diseases even though they have never come in contact individually with cases of the disease. The demonstration in the ova of such forms as discovered by Koch furnishes evidence of the manner of this transmission. Christophers[6] has followed carefully the formation of these bodies and their penetration into the ova, where they become spherical resting stages. He has also traced these bodies through larva to nymph and thinks that when the latter become adult the parasites have migrated into the salivary glands. It has long been known that Texas fever was conveyed by the progeny of infected ticks, but the demonstration of the infective agents has heretofore eluded observation.

Several authors, among whom Carter[7] may be mentioned, have shown that *Spirochaeta Duttoni* infects the ova of ticks which suck the blood of hosts harboring this parasite, that the organisms multiply in the ova and that by them the new generation of ticks is infected and may transmit the disease produced by the parasite. Other instances of the same type might be added to the list. The process may, however, go one step farther.

Recently reported investigations of several observers show that in the housefly a parasitic flagellate infects the ova and thus the subsequent generation of its host. Since the host is no longer a blood-sucking insect, there is no possibility of a sanguinicolous generation of the parasite in some other host. Probably the hereditary method is the only one by which the parasite is propagated and new generations of flies are infected, although it is possible that encysted forms, discharged in the feces, might be taken up in the food of some other fly. It is interesting to note in this connection some work done in my laboratory by Mr. L. D. Swingle, who has followed out the life-history of a similar flagellate parasitic in the sheep-tick. As is well known, this host is really a degenerate fly, and this parasite has, so far as can be ascertained, no relation to the blood-sucking habit of its host. It infects the ova and in a resting stage awaits there the development of the next generation, but no stages were found indicating any other method of transmission.

These instances just outlined differ radically from those noted at first in which the organisms traverse the placenta and gain entrance to the offspring *in utero*. The latter involve, as already

[6] *Indian Med. Gazette*, December, 1906, 467.

[7] *Ann. Trop. Med. and Par.*, 1, 157.

indicated, no modification or adaptation in the process of reproduction. But in the infection of the ova with a resting stage is involved a selection both of the definite organ and of the cell which becomes infected. Further, the parasite must assume a resting condition adapted to undergo successfully the changes indicated in the development of the adult insect from the eggs and sometime in the latter process must reach the suitable location. In the case of the fly such a location will be the alimentary canal of the insect, while in the tick which is to transmit the disease-producing organisms the suitable location will be rather the salivary glands, as suggested by the observations of Christophers. In any event the interrelations are evidently extremely complicated. The infection of the fetus by tissue-penetrating protozoa is purely incidental; the infection of the ova and through them of the second generation is a complicated biological process, involving essential modification in the life-history of the parasite and important morphological adaptations to new conditions of life.

A Society for the Destruction of Vermin.—Recent demonstrations as to the agency of mosquitoes, flies, bedbugs, rats and other household pests in transmitting serious diseases has taken such active hold on the British mind that there has been organized in London a Society for the Destruction of Vermin. It is incorporated under the Board of Trade regulations as a public association not formed for the object of making profit. The work the society has set itself to do is: (1) Collect information from all sources on the distribution and life-history of vermin. It will pay special attention to the part played by vermin in disease causation. (2) Disseminate as widely as possible the acquired knowledge by means of the general press, and also by special reports, leaflets and lectures. It will endeavor to make known to the public the dangers connected with each kind of vermin, the necessity for exterminating certain species, and the best means of destruction. (3) Carry out experiments in the field, test any promising measures suggested for the destruction of vermin, and, if funds permit, distribute gratuitously, to such persons as are unable to afford the expense, the necessary substances and apparatus. (4) Organize, in cooperation with other associations and public bodies, a practical campaign for the destruction of vermin. To conduct operations an active committee has been formed. (5) Encourage and assist in any legitimate